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ABSTRACT

This module, one of 25 on vocational education training for careers in environmental health occupations, contains self-instructional materials on operating high-volume air samplers. Following guidelines for students and instructors and an introduction that explains what the student will learn are three lessons: (1) disassembling the high-volume sampler, naming and identifying its major components, and explaining the purpose or function of each component; (2) operating the sampler, inspecting it for defects, and performing routine maintenance; and (3) plotting a calibration curve for a field-type rotameter. Each lesson contains objectives, recommended methods and locations for practice, performance criteria, equipment and supplies to perform a task, detailed step-by-step instructions for learning a task, and performance exercises. Performance tests cover subject matter of each lesson. (CT)

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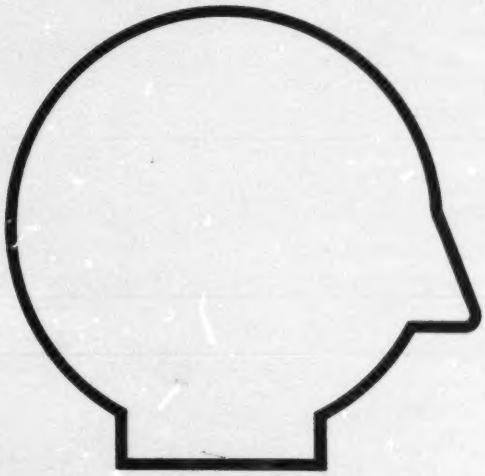

Operating High-Volume Air Samplers

Module 3

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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CE 029 483

FOREWORD

The Curriculum and Instruction Branch of the Office of Vocational and Adult Education, U.S. Department of Education, identified a need to improve the training opportunities for vocational education students interested in pursuing careers in environmental health. To fulfill that need, Consumer Dynamics, Inc., a Rockville, Maryland, based company, was awarded the contract to develop performance-oriented, competency-based modules in the environmental health sciences.

USING HIGH-VOLUME AIR SAMPLERS is one of the modules in the series, "Vocational Education Training in Environmental Health Sciences." The module content is based on selected materials in the environmental health field. The module is intended to supplement existing course materials.

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USING THESE SELF-INSTRUCTION MATERIALS

This self-instruction learning package or module is designed to allow both students and instructors flexibility of use. Although primarily intended for use in existing training programs, the module can be used by anyone interested in learning new skills or perking up old ones. Therefore, two sets of guidelines are presented--one set addressed to students and the other set addressed to instructors. First, find out how you, the student, should use the materials in this book.

GUIDELINES FOR STUDENTS

Take the Performance Test as a pretest.

When you pick up this book and work through it, your goal is not a letter grade or a high score on an exam. Instead, you will work to develop skills that you can measure. You will not have to worry about how well someone else is doing. Before you start work on this book, you should, first, find out if you have sufficient skills to start training by reading the section called PERFORMANCE TEST. If you think you can do all or most of the items in this test, ask your instructor to obtain the necessary equipment and supplies. Although you do not need special preparation in mathematics or physics to do this module, you should have some working knowledge of science. You do not have to have specialized skills to enter training in this module.

Work on parts you need to practice.

If you do everything well, according to the criteria in the Performance Test guidelines, you will not need to spend time working on this module. If after taking the Performance Test you discover there are parts you need to practice, follow the key to each item in FOR FURTHER STUDY.

Work straight through each lesson in the order presented.

Should you decide to completely work through this book, begin with the INTRODUCTION and go straight through each of the three lessons. The lesson begins with the OBJECTIVE of the training. Follow the instruction for each part in the order presented. Practice each step in a lesson until you can do it according to the criteria stated for the step. At the end of a lesson, do the EXERCISES. When there are audiovisuals listed at the end of a lesson, ask your instructor for help in obtaining them.

USING THESE SELF-INSTRUCTION MATERIALS

Take the Performance Test as a posttest.

Finally, after you have mastered all of the exercises in each lesson, ask your instructor to watch you do each item in the Performance Test. The items in the Performance Test are intended for use as a posttest to evaluate the quality of your performance. Turn now to the Performance Test.

GUIDELINES FOR INSTRUCTORS

Approach

The approach of these materials is to provide the student with the skills to accomplish all of the objectives at a satisfactory level of skill. The modules use instrumentation commonly found in technical laboratories. You may find that the instrument(s) found in this module differ from those you have available. You may need to write supplementary instructions to point out the equipment differences. The skills tested on the Performance Test are designed for use with any make and model of instrumentation.

Independent Study

Students can work independently and at their own pace. Depending on the time frame you set for completing each lesson, you may want to start a group off in each lesson with a demonstration and informal presentation.

As a Laboratory Workbook

Alternatively, you may choose to use this module as a laboratory workbook in a structured laboratory session. With this option, you may allow students greater access to your assistance, especially in watching them perform the pre- and posttest portions of the training.

General Instructions

Read through each lesson to anticipate what equipment and supplies you will need to make available for students to use. Also, order any audio-visuals or reading materials you think may present a complementary perspective to the training in this module. Use the items in the Performance Test as the minimum requirements for gauging successful completion of the training.

INTRODUCTION

BACKGROUND

The U.S. Environmental Protection Agency (EPA) is the primary Federal government agency responsible for monitoring and regulating the extent of pollution in the environment. Since air pollution is an area of EPA concern, EPA's environmental scientists have developed criteria for establishing airborne dust standards.

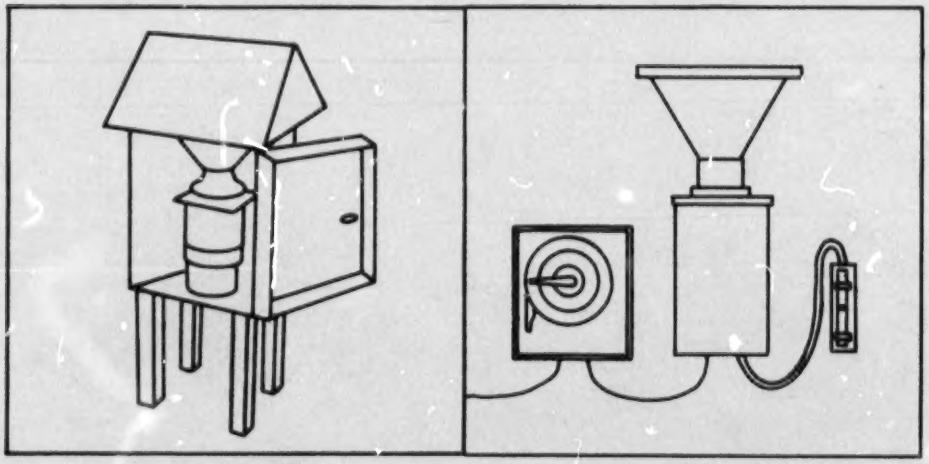
To find out what quantity of dust is in the ambient environmental air, a device must be used to filter large quantities of air in order to have a sufficient size sample to analyze. The high-volume air sampler, or "hi-vol," is one type of device that can be used for collecting dust to make such measurements. A hi-vol consists of a vacuum cleaner motor that pulls air through a filter made of glass fibers. Dust in the air is then trapped and held by the filter. Hi-vols usually run for a period of 24 hours. They are turned on and off automatically by electric timers and operate from 1 minute after midnight of one day to midnight of the next day. By weighing the filters before and after they are used, and by knowing the volume of air pulled through the filter, an analytical laboratory can calculate the amount of dust in a unit volume of air.

The EPA, assisted by State and local governments, has established a network of air sampling stations throughout the country. Measurements of total suspended particulate (dust) using hi-vol samplers are one type of data collected by the monitoring stations. This data can then be used to evaluate the Nation's air quality. In addition to the nationwide monitoring system, there are many special studies conducted by government and industry to evaluate air pollution levels at specific locations. For example, special studies are often performed around steel mills, quarries, and cement plants. The purpose of these studies is to evaluate dust levels and the effectiveness of pollution controls.

For any of these data to be meaningful, the sampling equipment must be properly calibrated and operated. With the passage of time, certain parts of the sampler will need to be inspected, replaced, and cleaned.

WHAT YOU WILL LEARN

When you finish working through the steps and exercises in this module, you will be able to name and identify the major components of a high-volume air sampler as well as operate, maintain, and calibrate the unit in the field.



You will learn these skills in three lessons:

- o Lesson One

  You will be able to disassemble the high-volume sampler, name and identify its major components, and explain the purpose or function of each component.

- o Lesson Two

  You will be able to operate the high-volume air sampler, inspect it for defects, and perform routine maintenance procedures.

- o Lesson Three

  You will be able to plot a calibration curve for a field-type (visifloat) rotameter by using an orifice calibrator and a U-tube manometer.

LESSON ONE

OBJECTIVE

You will be able to disassemble the high-volume air sampler, name and identify its major components, and explain the purpose or function of each component.

WHERE AND HOW TO PRACTICE

You should practice doing this lesson on a worktable where there is room to spread out the parts and also this book. Since the high-volume sampler motor housing may contain loose carbon dust, the worktable should be covered with newspaper to make cleanup easier. The carbon dust will also get on your hands, so be sure you work someplace where you will be able to wash your hands afterwards. Read through each step before attempting to do it, and make sure you can perform the step as well as described in "How Well You Must Do." Practice labeling the parts by using the diagrams in "Exercises."

HOW WELL YOU MUST DO

You must be able to name and identify all parts of the high-volume air sampler, disassemble it to the point described in the lesson, and describe in your own words how the sampler and each of its parts function. Cover all of the points made in the lesson about each part.

THINGS YOU NEED

In addition to a high-volume air sampler, such as a General Metal Works Model GMWL-2000, a Model FM-2100 Filter Holder, and a visi-float rotameter, you will need the following:*

- large-handled screwdriver, 1/4-inch blade
- small-handled screwdriver, 1/8-inch blade
- pliers or small crescent wrench
- manufacturer's instructions.

Instructions: Now turn to the next page and begin work on Lesson One, "Getting There--Steps."

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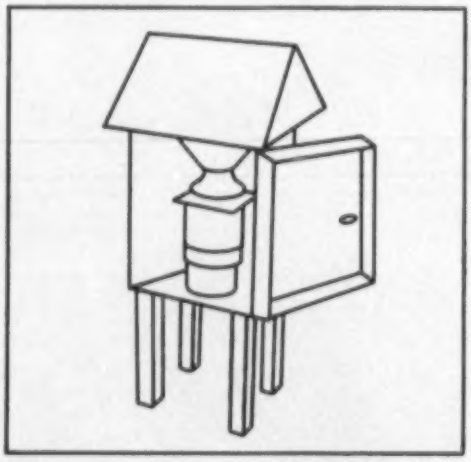
*Presentation of information in this module on any type or model of equipment should not be construed as an endorsement of the equipment by the U.S. Department of Education.

GETTING THERE--STEPS

STEP 1

If the unit you intend to use is in a shelter at a field station, move it to your work area. Unplug the power cord and remove the sampler from the shelter.

KEY POINT 1

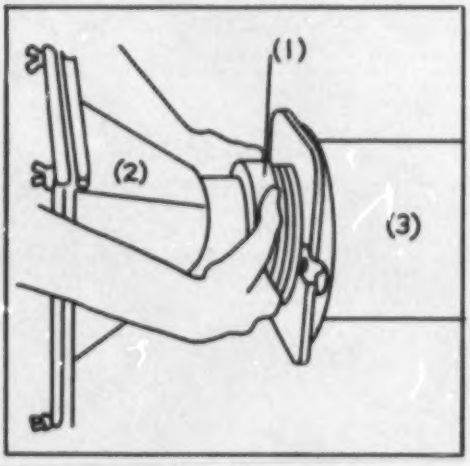


Remove the unit from the shelter.

STEP 2

Place the hi-vol on a newspaper-covered worktable and grasp the filter holder retaining ring (1) and turn it counterclockwise until the filter holder (2) can be removed from the blower motor assembly (3). The filter holder assembly supports the glass fiber filter on which the dust sample will be collected.

KEY POINT 2

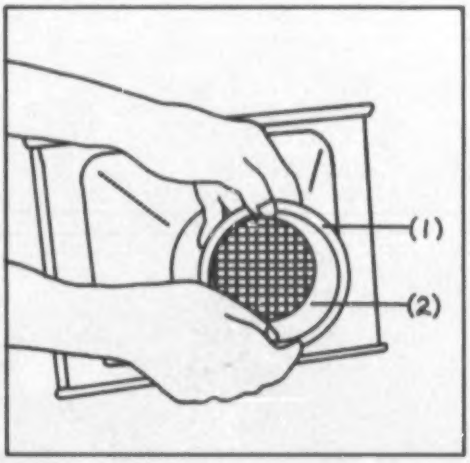


Loosen the filter holder retaining ring by turning it counterclockwise.

STEP 3

Reach inside the filter holder retaining ring (1) and remove the neoprene gasket (2). The gasket prevents air leakage between the filter holder assembly and the motor mounting plate cover.

KEY POINT 3

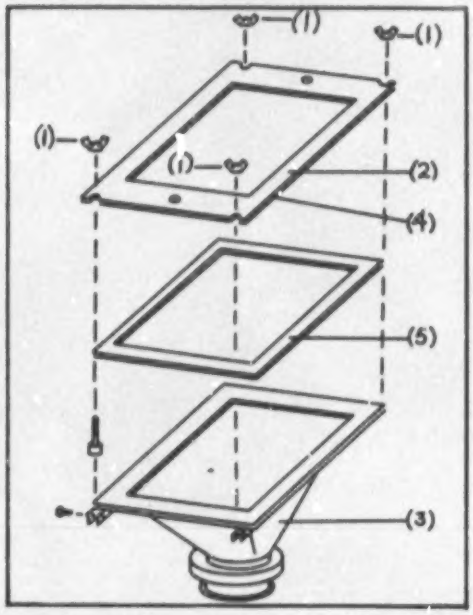


Remove the neoprene gasket from the filter holder assembly.

STEP 4

Loosen the four wingnuts (1) that secure the hold-down frame (2) to the filter holder assembly (3). Remove the hold-down frame and turn it over. Locate the rubber gasket (4), glued to the underside of the hold-down frame. The hold-down frame secures the glass fiber filter (5) to the surface of the filter holder assembly; the rubber gasket prevents air leakage between the hold-down frame, the filter, and the surface of the filter holder assembly.

KEY POINT 4



Remove the filter hold-down frame and locate the gasket.

STEP 5

Place the hold-down frame back on top of the filter holder assembly and tighten the wingnuts. Place the neoprene gasket back inside the filter holder retaining ring. Put the reassembled filer holder assembly off to one side.

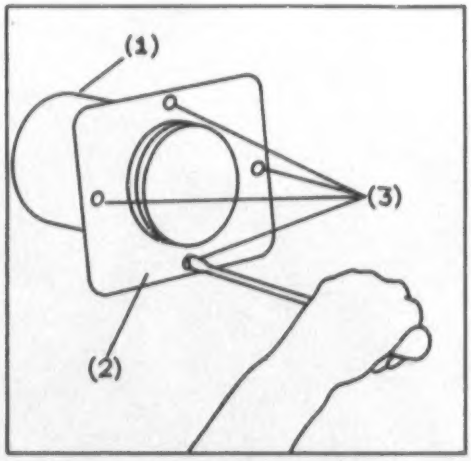
KEY POINT 5

Replace the filter hold-down assembly and neoprene gasket.

STEP 6

Turn the blower motor assembly (1) so that the mounting plate motor cover (2) faces you. Using the large-handled screwdriver with the 1/4-inch blade, remove the four screws (3) that hold the mounting plate motor cover to the motor housing. Remove the mounting plate motor cover from the motor housing.

KEY POINT 6

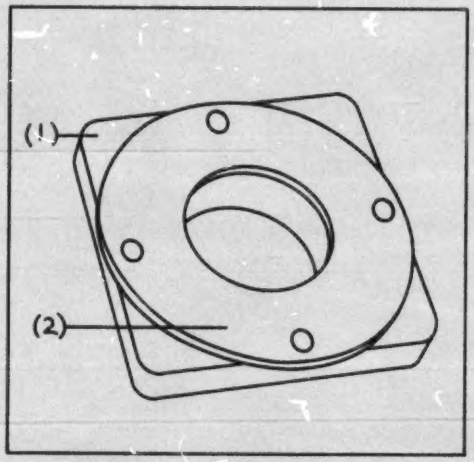


Remove the four screws that hold the mounting plate motor cover.

STEP 7

Turn the mounting plate motor cover (1) over and identify the neoprene gasket (2), which is glued to the bottom. This gasket prevents air leakage between the blower motor and the mounting plate motor cover.

KEY POINT 7

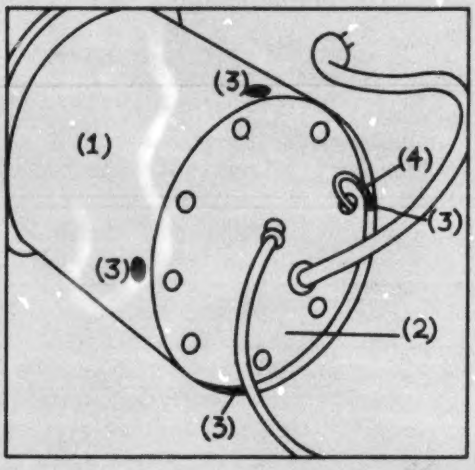


The gasket prevents air leakage.

STEP 8

Turn the blower motor assembly (1) so that the orifice plate (2) mounted on the bottom of the motor housing faces you. Notice that the orifice plate is held in place by four screws (3) that go through the motor housing. Notice, too, that one of these screws has a green wire (4) attached to it. This wire is the ground wire of the power cord. It provides an electrical path to the ground to prevent shock hazards.

KEY POINT 8

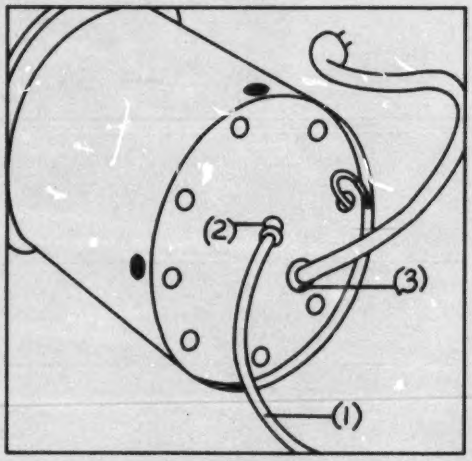


Locate the green ground wire.

STEP 9

With the orifice plate still facing you, identify the tubing (1), pressure tap assembly (2), and power cord grommet (3). Using the small-handled screwdriver with the 1/8-inch blade, remove the four screws that hold the orifice plate and slide the plate back over the power cord.

KEY POINT 9

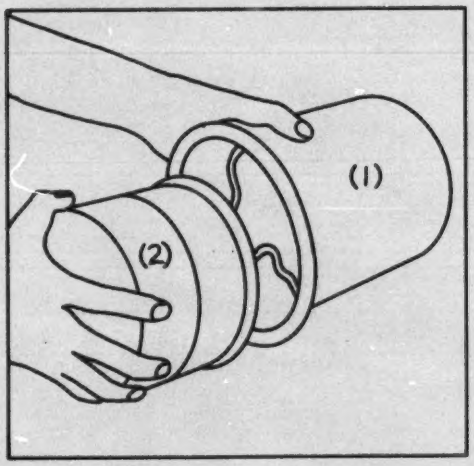


Locate the tubing, pressure tape, and power cord grommet.

STEP 10

Grasp the motor housing (1) with one hand and the blower motor (2) with the other and remove the blower motor from the motor housing. You may have to turn the motor housing upside down and shake it a little to loosen the blower motor. Slide the blower motor out of the housing so that you can rest it face down on the worktable. The blower motor provides suction needed to pull air through the filter.

KEY POINT 10

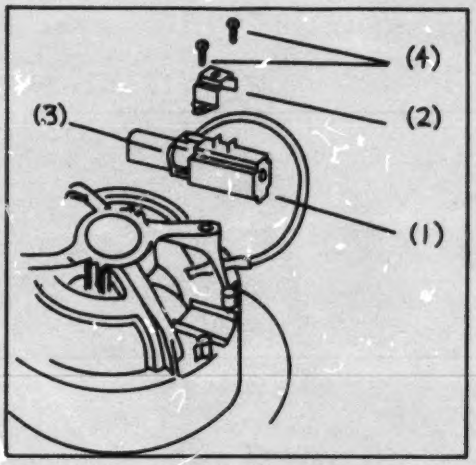


Remove the blower motor from the motor housing.

STEP 11

With the blower motor face down on the worktable, identify the brushes and brush-holder (1), the brush holder clamp (2), the brass brush clips (3), and the brush clamp mounting screws (4). Remove the screws and set the brush assemblies aside.

KEY POINT 11

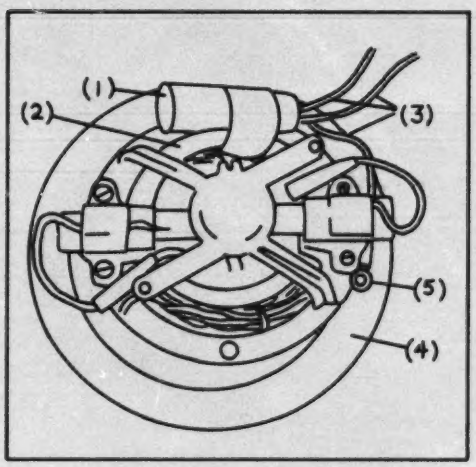


The brushes are conductors of electricity.

STEP 12

Locate the capacitor (1) attached to the motor frame (2) and notice that it has three wires (3) coming out of it. Notice that one of them is connected to the motor mounting ring (4) with a lug and screw (5). The other two wires from the capacitor are connected with wire nuts to the black and white wire of the power cord and to wires going to the blower motor. Label each wire before disconnecting it. The capacitor helps to reduce the noise of the motor.

KEY POINT 12

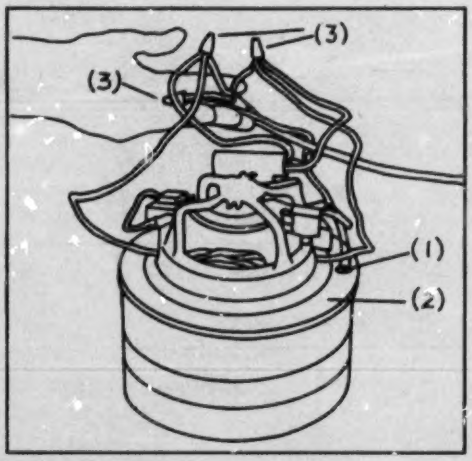


Trace the capacitor wires.

STEP 13

Using the 1/8-inch screwdriver, remove the one capacitor wire (1) from the motor mounting ring (2). Remove the wire nuts (3) and separate the three wires (capacitor, motor blower, power cord) that are twisted together.

KEY POINT 13

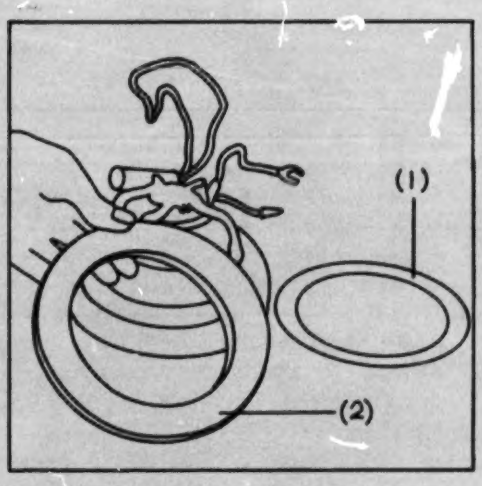


Remove the capacitor wire from the motor mounting ring and remove the wire nuts.

STEP 14

Remove the motor mounting ring and place it to the side. Between the motor ring (1) and the blower motor is a ring of sponge rubber (2) about 1/2-inch thick. This is the motor cushion, which reduces vibrations of the blower motor. Remove the motor cushion.

KEY POINT 14

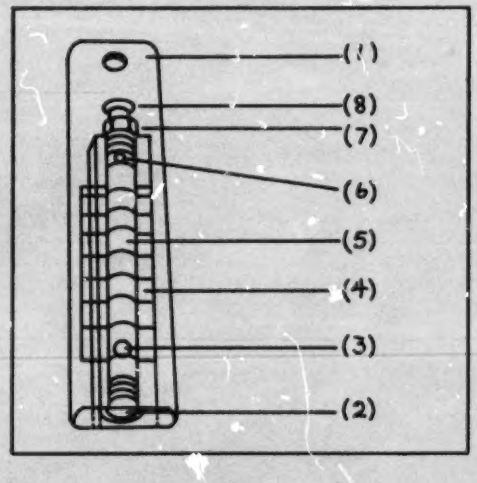


Identify the motor cushion.

STEP 15

Locate the rotameter mounted on the outside of the motor housing, and identify the following components: backing plate (1), base screw (2), ball (3), scale (4), tapered plastic tube (5), exhaust orifice (6), lock nut (7), and adjusting screw (8). The rotameter measures airflow through the hi-vol cubic feet per minute. Disassemble the rotameter: Remove the lock nut, adjusting screw, ball, and bottom screw according to the manufacturer's instructions.

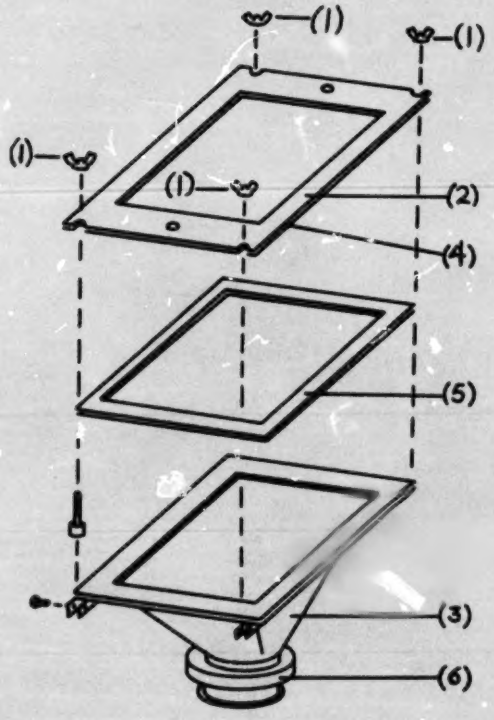
KEY POINT 15



Identify the parts of the rotameter.

EXERCISES

Instruction 1: Correctly label each of the following parts. Tell your instructor how each part works and enter this information into your notebook.



(1) _____

(2) _____

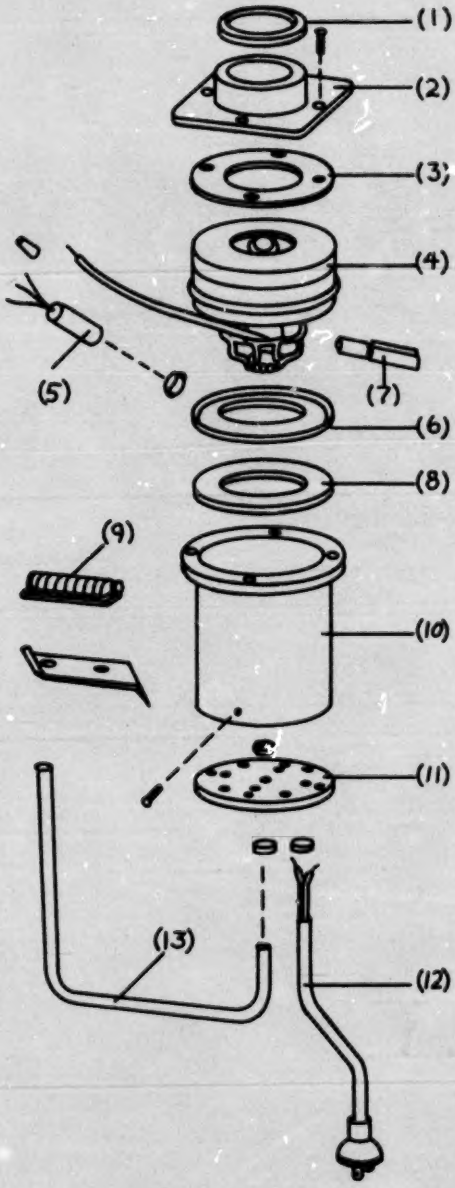
(3) _____

(4) _____

(5) _____

(6) _____

Instruction 2: Correctly label each of the following parts. Tell your instructor how each part works and enter this information into your notebook.



(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

(7) _____

(8) _____

(9) _____

(10) _____

(11) _____

(12) _____

(13) _____

Instruction 3: Repeat Lesson One using a high-volume air sampler made by a different manufacturer. Point out what differences there may be in each sampler. If there are great differences, look at the manufacturer's operating manual for a description of parts and how they are used.

LESSON TWO

OBJECTIVE

You will be able to operate the high-volume air sampler, inspect it for defects, and perform routine maintenance procedures.

WHERE AND HOW TO PRACTICE

Continue using the area you selected for practicing Lesson One. Before doing any work on the hi-vol, carefully read each step. If you have any question about how to perform any step in this lesson, request help from your instructor. When you complete this lesson, the hi-vol must work properly so that you may proceed with the calibration procedure in Lesson Three.

HOW WELL YOU MUST DO

You must be able to set the hi-vol up for operation; install a filter; set the timer; and inspect, identify, and replace worn parts as necessary.

THINGS YOU NEED

In addition to the hi-vol you have been using, you will need the following:

- a few pipe cleaners
- old rags, two pieces (2x2 feet)
- household ammonia, 2 ounces (60 ml)
- solvent (acetone, methyl ethyl ketone, or alcohol), 1 quart
- putty knife, 1-inch-wide blade
- new gaskets and motor cushion

THINGS YOU NEED (cont'd)

- rubber cement, 6-ounce bottle with brush applicator for reglueing rubber gaskets and cushions
- glue (plastic cement type)
- new motor brushes
- unused 8x10-inch glass fiber filter
- 7-day electric timer (Paragon Type 7008-0)*
- data collection forms used by your company or agency
- Variac transformer*, 0-120 volts AC
- paper towels.

Instructions: Now turn to the next page and begin work on Lesson Two, "Getting There--Steps."

*Use of this model equipment should not be construed as an endorsement by the U.S. Department of Education.

GETTING THERE--STEPS

STEP 1

Reassemble the blower motor. Follow the manufacturer's instructions for cleaning various parts as part of a routine maintenance program. Repeat the instructions in Lesson One, only in reverse. Make sure parts are completely seated in their grooves, and wires are routed through the motor casing and reconnected to the proper terminals.

KEY POINT 1

Replace parts in the proper sequence, with correct positions and connections.

STEP 2

As you reassemble the sampler, check the gaskets and rubber cushions to make sure they are not cracked, torn, or dried out. Replace them as needed; reglue them with rubber cement.

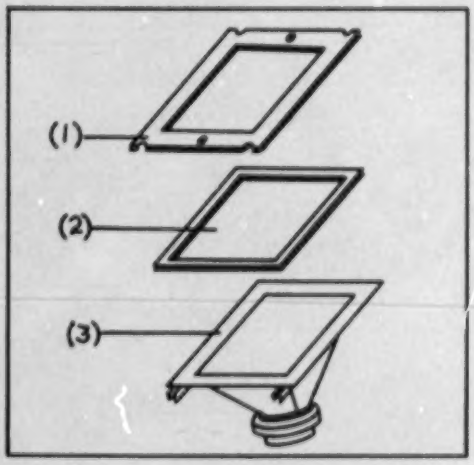
KEY POINT 2

Check the condition of all rubberized parts as you reassemble the sampler.

STEP 3

Remove the filter hold-down frame (1) and place a clean 8x10-inch glass fiber collection filter (2) on top of the support screen (3) so that the rough side of the filter faces up and the stamped number faces down. The edges of the filter should be lined up with the edges of the support screen.

KEY POINT 3



The filter should be installed number side down.

STEP 4

Place the entire unit in a hi-vol shelter, or support it in an upright position on the tabletop.

KEY POINT 4

Support the unit in an upright position.

STEP 5

Plug the power cord into a Variac transformer set at 50 volts and allow the hi-vol to run for about 20 minutes. This allows the brushes to "seat-in" properly. Assume the unit has been calibrated prior to this lesson.

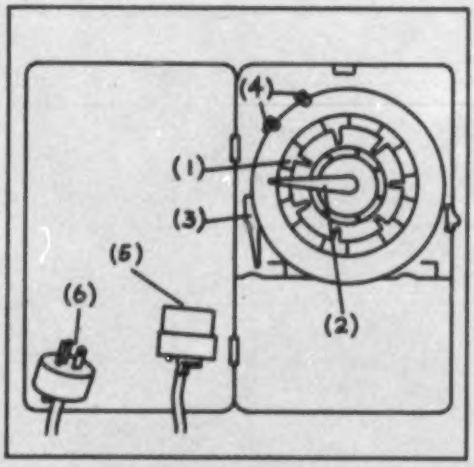
KEY POINT 5

Operate the hi-vol for 20 minutes at 50 volts AC.

STEP 6

Look at the 7-day timer and identify the following parts: movable clockface (1) pointer (2), on/off lever switch (3), set point tabs (4), power outlet cord (5), power cord, and plug (6).

KEY POINT 6

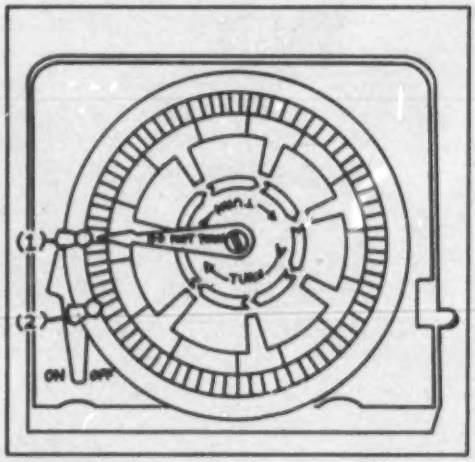


Identify timer parts.

STEP 7

Rotate the clockface so that the pointer lines up with the current date and time. Loosen the thumbscrew on the set point tabs and adjust the tabs so that the silver "on" tab (1) is lined up with the current hour and the black "off" tab (2) is set for 24 hours later.

KEY POINT 7



Set the timer by adjusting the set points.

STEP 8

Check the on/off level switch to be sure it is on the "off" position, and plug the hi-vol into the power outlet cord. Obtain a clean filter, record the number on a data sheet, and install the filter. Do not reuse a seemingly clean filter if it has been used previously for sampling. If you have no record on the filter, discard it.

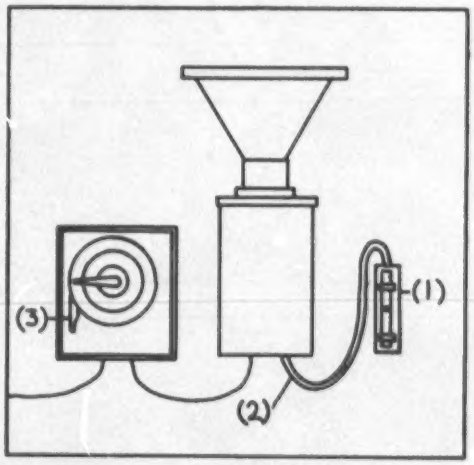
KEY POINT 8

Plug the hi-vol into the timer and install a clean filter.

STEP 9

Connect the top part of the rotameter (1) to the tubing (2) attached to the bottom of the orifice plate. Turn the lever switch (3) on the timer to the "on" position.

KEY POINT 9

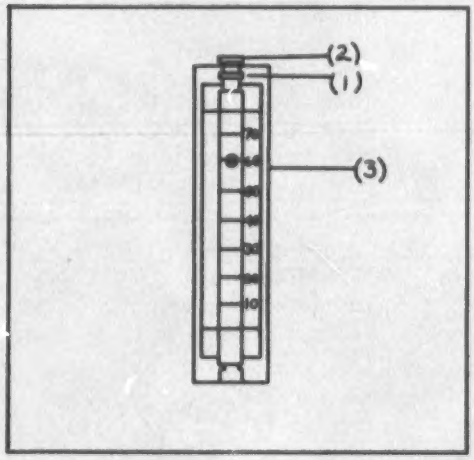


Connect the rotameter to the hi-vol and timer.

STEP 10

Observe the floating ball. It is the widest part of the ball that should be read. Hold the rotameter vertically, loosen the lock nut (1) and set the adjusting screw (2) so that the middle of the ball (3) reads 60 on the flowmeter.

KEY POINT 10

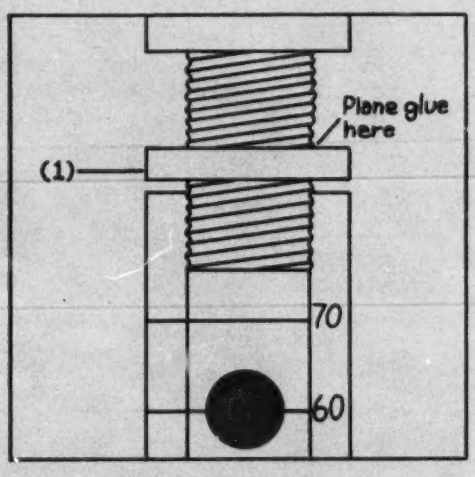


Set the rotameter ball to read 60.

STEP 11

When the adjustment is made, tighten the lock nut (1) and place a drop of airplane glue on the nut and thread to hold the nut in place. Turn the hi-vol off; it is now ready for calibration.

KEY POINT 11



Secure the adjusting screw with a drop of glue.

EXERCISES

Instructions: If this were a real sampling situation, the hi-vol would continue running until midnight of the next day. At that point the timer would shut the unit off. When the operator returns to change the filter for the next sample, he or she would first turn the sampler on and take another reading using the rotameter. The operator would record this ending flow rate on the data sheet. For purposes of this exercise, you should take a rotameter reading when you come in in the morning and record this reading as your ending flow rate.

LESSON THREE

OBJECTIVE

You will be able to plot a calibration curve for a field-type (visifloat) rotameter by using an orifice calibrator and a U-tube manometer.

WHERE AND HOW TO PRACTICE

You should continue working in the area where you performed Lessons One and Two. Read each step of the calibration procedure carefully before attempting to do it, and make sure you can perform the step as well as described in "How Well You Must Do."

HOW WELL YOU MUST DO

You must be able to install each of the resistance plates in the calibration orifice, read the U-tube manometer, determine the actual flow rate using the orifice calibration curve, and calibrate the rotameter.

THINGS YOU NEED

In addition to the hi-vol you have been using, you will need the following:

- o calibration orifice adapter General Metal Works Model GMW-25
- o set of resistance plates
- o U-tube manometer, 0-20 inches of water
- o length of tubing for connecting the manometer to the calibration orifice
- o orifice calibration curve
- o calibration data sheet.

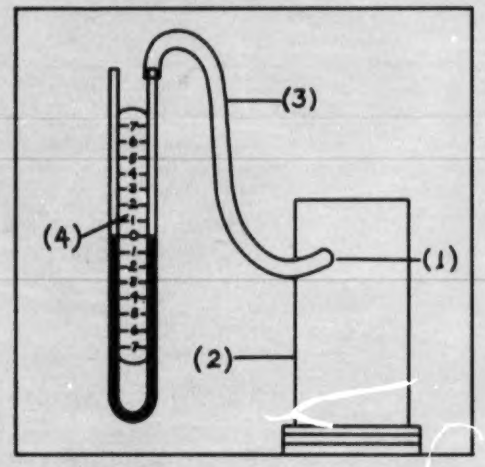
Instructions: Now turn to the next page and begin work on Lesson Three, "Getting, "Getting There--Steps."

GETTING THERE--STEPS

STEP 1

Remove the filter holder assembly from the blower motor unit and set it aside. Connect the pressure tap (1) on the side of the calibration orifice adapter (2) to one leg of the U-tube manometer (3) and zero the manometer by sliding the scale (4) so that the edge of the water is lined up with the "0" line on the scale. Keep the manometer vertical while using it.

KEY POINT 1

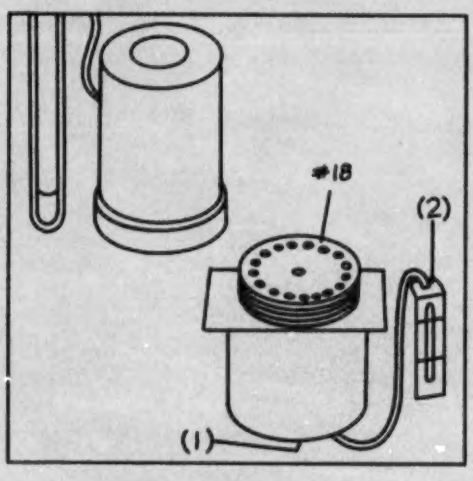


Zero the manometer.

STEP 2

Connect the pressure tap (1) on the orifice plate on the bottom of the hi-vol to the inlet point of the rotameter (2), and place the #18 resistance plate on top of the mounting plate motor cover opening. Keep the rotameter vertical while using it.

KEY POINT 2

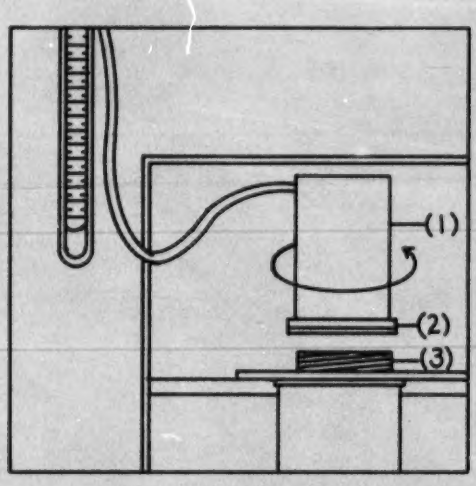


Install the #18 resistance plate and connect the manometer.

STEP 3

Place the calibration orifice adapter (1) on top of the #18 resistance plate and tighten the assembly ring (2) on the adapter to secure the adapter to the mounting motor plate cover (3).

KEY POINT 3



Screw the calibration adapter onto the motor mounting plate.

STEP 4

Turn the hi-vol on and allow it to run for about 5-10 minutes. While the hi-vol is running, you should see a difference in water level in the two legs of the manometer.

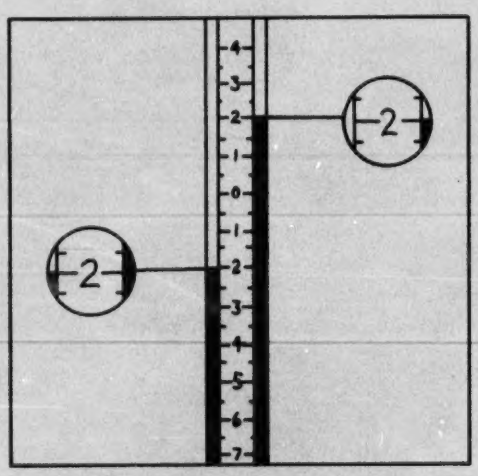
KEY POINT 4

Observe the difference in the manometer legs.

STEP 5

Read each leg of the manometer as shown in Key Point 5 and add the two together. The total is the manometer reading in inches of water.

KEY POINT 5

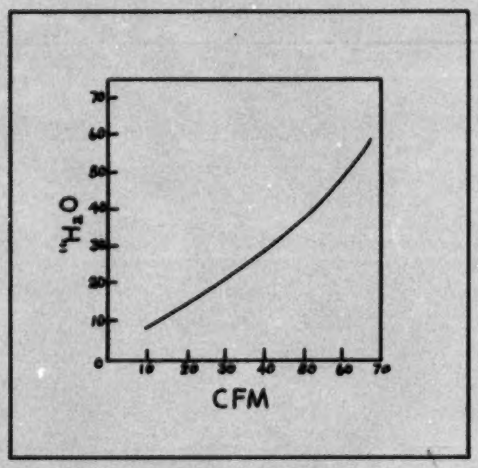


Add readings in the legs of the manometer.

STEP 6

Locate the number of inches of water you found in Step 5 on the vertical axis of the calibration curve, which is supplied with your calibration orifice adapter and resistance plates. A sample is enclosed at the end of this lesson.

KEY POINT 6

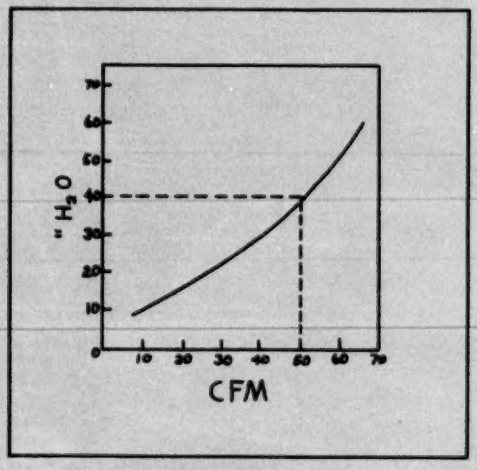


Find the manometer reading on the vertical axis.

STEP 7

Follow this line across the graph until it intersects the calibration curve. Follow the vertical line down and read the flow rate in cubic feet per minute.

KEY POINT 7



Find the flow rate in cubic feet per minute.

STEP 8

Enter the plate number, the rotameter reading, the manometer reading in inches of water, and the actual flow rate obtained from the calibration curve on the calibration data sheet.

KEY POINT 8

Record the data.

STEP 9

Unscrew the orifice calibration adapter from the blower motor assembly and replace the #18 resistance plate with the one with the next fewer holes (#16).

KEY POINT 9

Install the #16 resistance plate.

STEP 10

Reattach the orifice calibration adapter and read the new manometer reading as you did in Step 5.

KEY POINT 10

Read the manometer.

STEP 11

Repeat Steps 6 through 10 until you have used each of the resistance plates in your set.

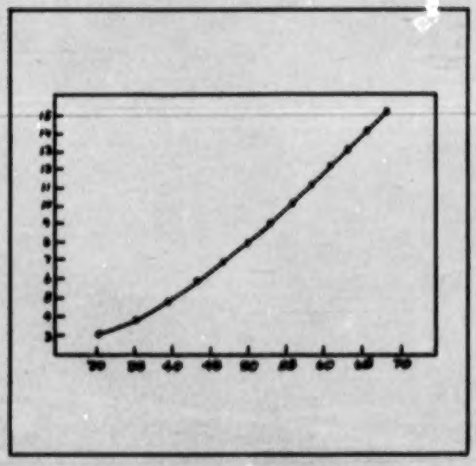
KEY POINT 11

Continue using each of your resistance plates.

STEP 12

Plot this data on the calibration data sheet by locating the rotameter reading on the horizontal axis and the actual flow rate in cubic feet per minute on the vertical axis. Connect the points with a smooth curve.

KEY POINT 12



Plot the relationship between the rotameter reading and the actual flow rate.

CALIBRATION DATA SHEET

HIGH VOLUME AIR SAMPLER CALIBRATION Unit No.: _____

Date: By: Plate | Indicated | True $"H_2O$ | Actual cfm

Temp.: At. Press: 18

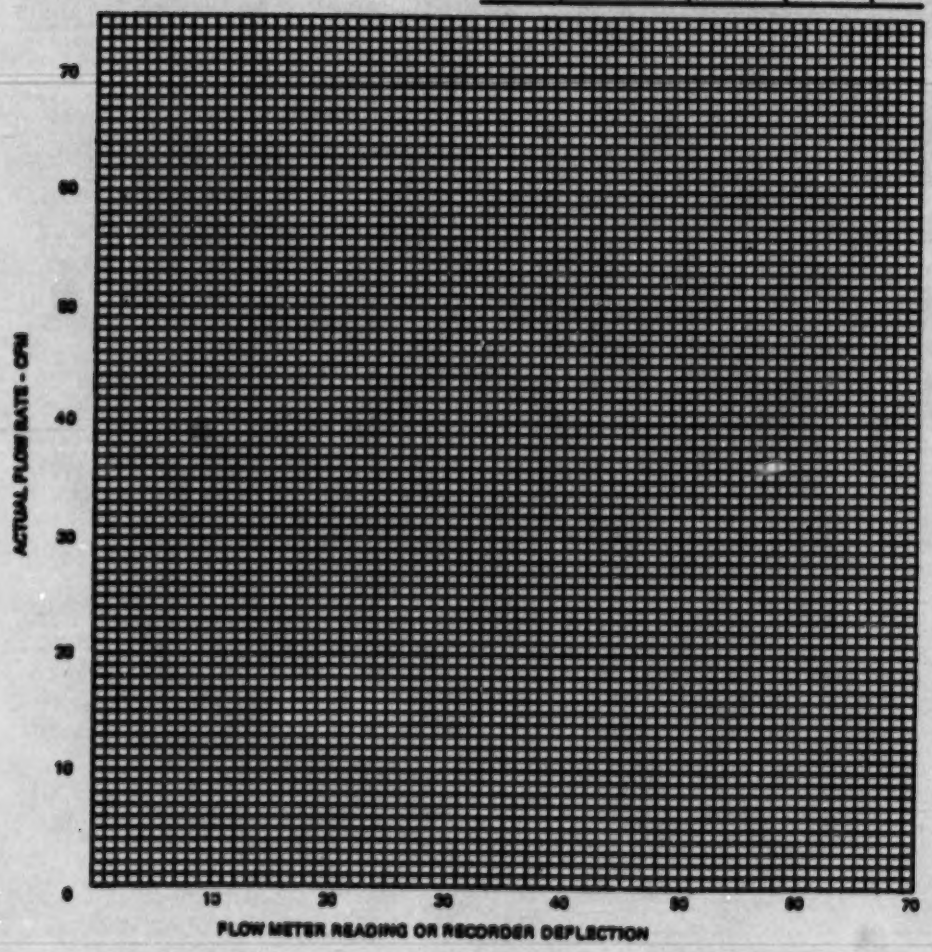
13

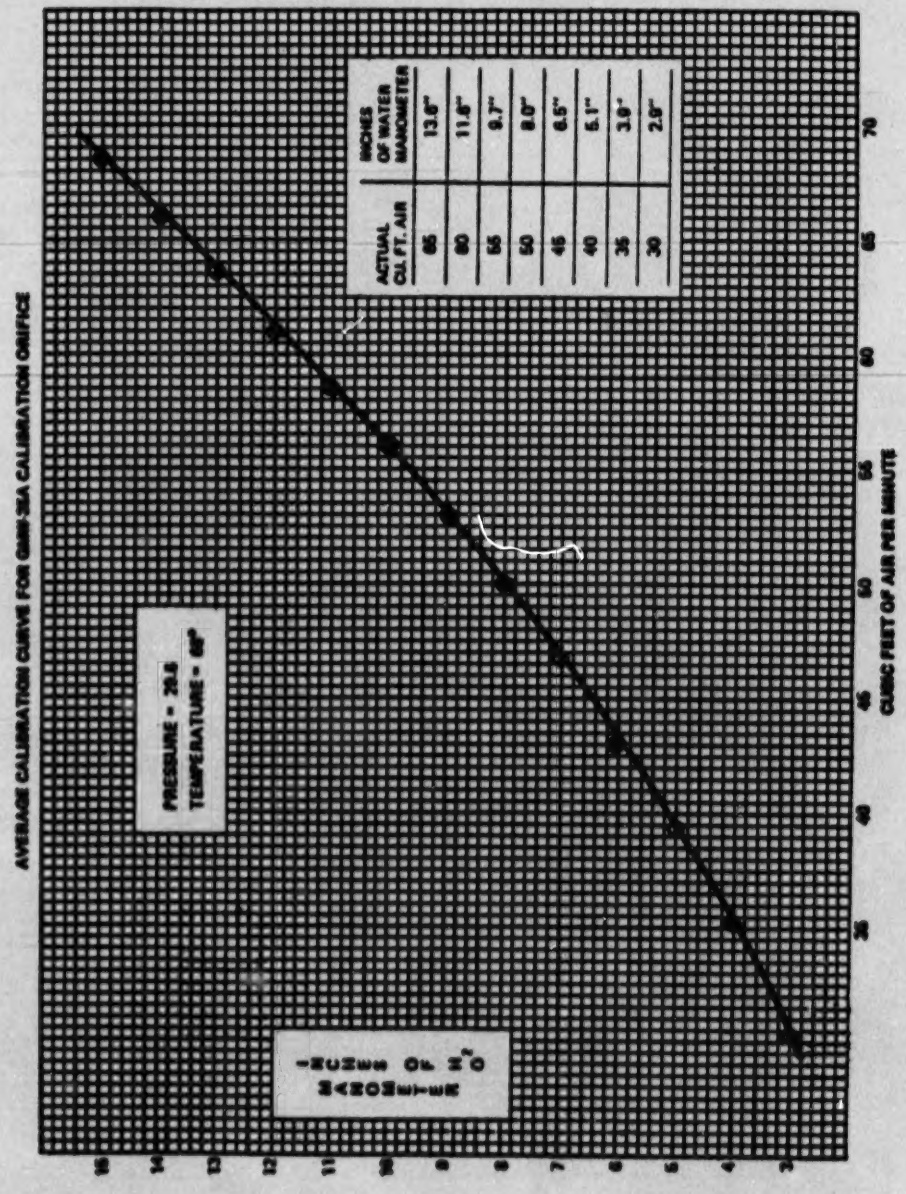
10

7

5

Remarks:




AVERAGE CALIBRATION CURVE FOR GMW-SEA CALIBRATION ORIFICE
PRESSURE - 29.8
TEMPERATURE - 68°
ACTUAL CU. FT. AIR
INCHES OF WATER MANOMETER
85 13.6"
80 11.8"
55 9.7"
50 8.0"
45 6.5"
40 5.1"
35 3.8"
30 2.8"
CUBIC FEET OF AIR PER MINUTE
INCHES OF H2O

EXERCISES

Instruction 1: Practice calibrating the rotameter with which you have been working. Work toward completing the steps within 45 minutes. Using the sample calibration curve paper supplied at the end of this lesson, practice developing calibration curves.

Instruction 2: Repeat Instruction 1 using a hi-vol of a different manufacturer.

PERFORMANCE TEST

Instruction 1: Check your skill level or progress by working through each of the items in this test. If you can perform each item as required, place a check in the space provided. When all of the items are checked, you are ready to demonstrate your skills to your instructor. You may use the following list if needed. You will be considered trained in a skill after your instructor approves your performance of each of the following items:

DISASSEMBLING HIGH-VOLUME AIR SAMPLERS

No. 1 ____ Remove the filter holder assembly from the blower motor assembly.

No. 2 ____ Remove the mounting plate motor cover from the motor housing.

No. 3 ____ Remove the orifice plate from the bottom of the motor housing.

No. 4 ____ Remove the blower motor from the motor housing.

No. 5 ____ Remove the brushes from the motor casing.

No. 6 ____ Remove the motor mounting ring and motor cushion.

No. 7 ____ Disassemble the rotameter.

FOR FURTHER STUDY

If you could not perform one or more of the 7 items above, review and practice the following lesson steps:

No. 1
Lesson One, Steps 2-5

No. 2
Lesson One, Steps 6 and 7

No. 3
Lesson One, Steps 8 and 9

No. 4
Lesson One, Step 10

No. 5
Lesson One, Step 11

PERFORMANCE TEST

No. 6
Lesson One, Steps 13 and 14

No. 7
Lesson One, Step 15

INSPECTING, OPERATING, AND MAINTAINING HIGH-VOLUME AIR SAMPLERS

Instruction 2: As you do each inspection item, tell your instructor what it is you are checking.

No. 1 ____ Reassemble the sampler.

No. 2 ____ Inspect and replace the motor cushion, as necessary.

No. 3 ____ Inspect the filter hold-down frame gasket and replace if necessary.

No. 4 ____ Inspect the filter holder assembly mounting ring gasket and replace if necessary.

No. 5 ____ Reattach the filter holder assembly to the blower motor assembly.

No. 6 ____ Install a clean glass fiber filter.

No. 7 ____ Connect the hi-vol to a Variac transformer and operate at 50 volts for 20 minutes.

No. 8 ____ Connect the hi-vol to a 7-day electric timer and adjust the set points to a time specified by your instructor.

No. 9 ____ Turn the hi-vol on and measure the flow rate using the rotameter.

No. 10 ____ Adjust the rotameter so the center of the ball is aligned with the 60 mark on the scale.

No. 11 ____ Secure the adjusting screw with a drop of glue.

FOR FURTHER STUDY

If you could not perform one or more of the 11 items above, review and practice the following lesson steps:

No. 1
Lesson Two, Step 1

No. 2
Lesson Two, Step 2

No. 3
Lesson Two, Steps 1 and 2

No. 4
Lesson Two, Step 1

No. 5
Lesson Two, Step 3

No. 6
Lesson Two, Step 3

No. 7
Lesson Two, Step 5

No. 8
Lesson Two, Steps 6 and 7

No. 9
Lesson Two, Step 9

No. 10
Lesson Two, Steps 9 and 10

No. 11
Lesson two, Step 11

CALIBRATING HIGH-VOLUME AIR SAMPLERS

Instruction 3: Continue checking your performance by calibrating the rotameter.

No. 1 ____ Connect the U-tube manometer to the calibration orifice adapter pressure tap and install the #18 resistance plate.

No. 2 ____ Turn the hi-vol on, and after 5-10 minutes read the inches of water indicated on the manometer.

No. 3 ____ Determine the actual flow rate using the manometer reading and the orifice calibration curve.

No. 4 ____ Remove the #18 resistance plate, and repeat No. 3 above using the other resistance plates.

No. 5 ____ Draw a calibration curve for the rotameter.

FOR FURTHER STUDY

If you could not perform one or more of the five items above, review and practice the following lesson steps:

No. 1
Lesson Three, Steps 1 through 3

No. 2
Lesson Three, Steps 4 and 5

No. 3
Lesson Three, Steps 6 through 8

No. 4
Lesson Three, Steps 9 through 11

No. 5
Lesson Three, Step 12

REFERENCES

General Metal Works, Inc. Operators Manual for the Model GMWL 2000 and Model GMWL 2000H, Cleves, OH (no date).

USEPA, Air Pollution Training Institute. Principles and Practice of Air Pollution Control, Manual 452. Research Triangle Park, NC, May 1974.